

## ***Interactive comment on “Nested-scale discharge and groundwater level monitoring to improve predictions of flow route discharges and nitrate loads” by Y. van der Velde et al.***

### **Anonymous Referee #1**

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The paper discusses how hydrologic data available at multiple spatial scales impact the validation/calibration of a conceptual, spatially-distributed hydrological model, and the ability to describe the underlying physical processes involved. This is done by focusing on a single case study, the Hupsel Brook catchment, which well serves to highlight the main idea of the paper. Overall, The paper is quite clear and well written. The Figures look pretty good, and have an adequate readability. The paper seems to be technically sound.

My major concern relates to the "prediction of nitrate loads". The model applied is

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indeed a flow model, no transport phenomena are included. As such, the model can not be used to predict nitrate loads. The assumption of constant concentrations in the different flow components done in section 3.5 can hardly be supported. Each flow component has his own temporal variability, which inevitably impacts the output flux concentration. Moreover, nitrates are subject to complex bio-geochemical cycling which dramatically impact the nitrogen soil availability in the long-term. Therefore, I would remove the nitrate part of the paper (which does not add much to your main conclusions), rather focussing on the flow processes alone. I list this as a minor revision, as it would require just some rearrangement of the tile and of the presentation of the results. Incidentally, I note that it would be really interesting to include a simplified model of nitrate transport and understand how chemical information can reduce/enhance uncertainty in model parameters.

I would also suggest to include more details on the model of the spatial distribution of groundwater depths, which seems to be a key point here. Some additional comments are provided below:

title: remove "and nitrate loads" and focus on flow processes: intro: I liked the introduction. You may consider to include some further refs to papers on nested experiments using tracer data and hydrologic measurements (e.g. Piovega Tre Comuni catchment, Italy) Too many subsections in sections 2 and 3 Section 2.2: are the GW depths assumed to be spatially correlated or random? any correlation with the soil depth or with the elevation? why did you use a normal distribution? Is the shape of the distribution constant with the spatial scale? Equations (3): notation: use the the unit-step function operator Section 3.5: 2 Figures and 1 Table are described very quickly here p. 8446, l.11-18: I suspect this is due to the fact that the flow volumes are better captured by the BPS-N (see above). The differences in the C prediction are indeed small. p. 8447, l.27-28: please rephrase this sentence.. a model approach can not change the contribution of tube-drain discharge, which is a physical process. figure 12: Mention what the grey and dark areas represent

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